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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/550,088 | 09/20/2005 | Ryoji Hoshi | 125361 | 9501 |

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OLIFF & BERRIDGE, PLC
P.O. BOX 19928
ALEXANDRIA, VA 22320

EXAMINER

SONG, MATTHEW J

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| ART UNIT | PAPER NUMBER |
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1722

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| MAIL DATE | DELIVERY MODE |
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08/08/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|------------------------|---------------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 10/550,088 | HOSHI ET AL. | |
| | Examiner | Art Unit | |
| | Matthew J. Song | 1722 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 September 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>9/20/05</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claims 8 and 14 are objected to because of the following informalities: Claims 8 and 14 are duplicate of claims 5, 11 and 17. Appropriate correction is required. The Examiner recommends canceling claims 8 and 14.

2. Claim 11 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The Examiner recommends canceling claim 11 because the limitations are recited in claim 5, from which claim 11 depends.

3. Claim 18 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The Examiner recommends canceling claim 18 because the limitations are recited in claim 6, from which claim 18 depends through claim 12.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-5 and 7-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tamatsuka et al (US 6,478,883) in view of Ikeda (US 6,099,641).

Tamatsuka et al discloses a method of producing a single crystal according to the Czochralski method comprising the steps of charging polycrystalline material into a crucible, heating and melting the polycrystalline material by a heater, immersing a seed crystal into the material melt, and then pulling the seed crystal to grow a single crystal, wherein the resistivity is controlled by doping with boron (col 11, ln 15-50 and Abstract).

Tamatsuka et al does not teach a heater disposed so as to surround the crucible and the highest temperature of the crucible is controlled to be 1600°C or less to grow the single crystal.

In a Czochralski method, note entire reference, Ikeda teaches a melt is heated by heaters arranged to around or around and below a crucible, this clearly suggests applicant's heater surround the crucible, and a single crystal is pulled under the condition of the local highest temperature of a quartz crucible of 1600°C or less (Abstract). Ikeda also teaches using a

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temperature of 1600°C or less to prevent the deterioration of the quartz crucible and dislocations caused by crucible deterioration (col 2, ln 20-50).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Tamatsuka et al by using the heater and temperatures taught by Ikeda to heat the melt evenly and prevent the deterioration of the quartz crucible and dislocations caused by crucible deterioration (col 2, ln 20-50).

Referring to claim 2-3, the combination of Tamatsuka et al and Ikeda teaches a resistivity of 10 mOhm-cm to 100 mOhm-cm, and an explicit example where the resistivity is 14-17 mOhm-cm ('883 col 11, ln 35-50 and col 13, ln 45 to col 14, ln 5). Overlapping ranges are held to be prima facie obvious (MPEP 2144.05).

Referring to claim 4, the combination of Tamatsuka et al and Ikeda teaches nitrogen doping and a nitrogen concentration of $1 \times 10^{10}/\text{cm}^3$ to $5 \times 10^{15}/\text{cm}^3$ ('883 col 12 ,ln 10-30).

Referring to claims 5, 8, 9, 10, , the combination of Tamatsuka et al and Ikeda teaches a single crystal ('883 Abstract).

Referring to claim 7, the combination of Tamatsuka et al and Ikeda teaches 8 inch diameter (200 mm) ('883 col 13, ln 45-60).

6. Claims 6 and 11-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tamatsuka et al (US 6,478,883) in view of Ikeda (US 6,099,641) as applied to claims 1-5 and 7-10 above, and further in view of Liao (US 5,904,767).

The combination of Tamatsuka et al and Ikeda teaches all of the limitations of claim 6, as discussed previously, except a magnetic field of at least 300 gauss or more is applied to the

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material melt to grow the single crystal. The combination of Tamatsuka et al and Ikeda does suggest the use of a magnetic Czochralski process ('883 col 20, ln 1-20).

In a method of producing a silicon crystal using magnetic Czochralski, note entire reference, Liao teaches using magnetic Czochralski where the crystal growth takes place in the presence of a magnetic field typically between about 500 and 4000 Gauss (col 1, ln 5-67). Overlapping ranges are held to be prima facie obvious (MPEP 2144.05). Liao also teaches using the magnetic field to improve the distribution of a dopant (Col 1, ln 5-67).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Tamatsuka et al and Ikeda by using the magnetic field of between 500 and 4000 Gauss, as taught by Liao, to improve the distribution of dopants within the crystal.

Referring to claims 11-20, the combination of Tamatsuka et al, Ikeda and Liao teach a silicon single crystal ('883 Abstract); a magnetic field of at least 300 Gauss ('767 col 1, ln 5-67) and a single diameter of 200 mm ('883 col 13, ln 45-60).

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

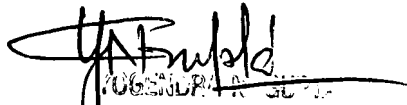
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
Art Unit 1722

MJS
July 30, 2007


SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1722